

WHAT IS CLAIMED IS:

1 1. A scheduling system comprising:
2 a time slot for specifying the transfer sequence of
3 individual lines in one turn, in which each cell is transferred,
4 in slots indicating respective points in the turn;
5 a cell read sequence management table which has elements
6 in the same number as the number of slots provided in the time
7 slot and sets the lines as cell transfer objects to the
8 elements;
9 schedule computation means for controlling the setting of
10 the lines to the cell read sequence management table;
11 allocation processing means for converting the elements
12 of the cell read sequence management table respectively to
13 specified positions of the slots in the time slot; and
14 a schedule management table for indicating positions,
15 within the cell read sequence management table, to which
16 transfer object lines are newly set, for each PCR value of the
17 lines, said PCR value being the number of cells, transferred
18 from the line, per cell transfer turn and representing the cell
19 send rate of each line,
20 the specified line cells being successively transferred
21 for each turn according to the sequence specified in the time
22 slot,
23 the cell read transfer sequence in each line being
24 controlled according to the cell send rate in each of the lines.

1 2. The scheduling system according to claim 1, wherein

2 the schedule computation means comprises:

3 means which, when a requirement is satisfied such that
4 there is an idle element, in the cell read sequence management
5 table, which is located one element ahead of a position of an
6 element corresponding to a value obtained by multiplying the
7 specified PCR value by an integer, and the contemplated line
8 can be set to continuous elements starting from the idle
9 element and corresponding to the specified PCR value and, in
10 addition, when an element is present in the heading area of the
11 continuous elements, functions to catalog the position of said
12 element, which is located one element ahead of a position of an
13 element corresponding to a value obtained by multiplying the
14 specified PCR value by an integer. as data indicating the set
15 position of the line having the specified PCR value, in
16 relation with the PCR value in the schedule management table;

17 means which, when a line to be newly transferred has
18 occurred, newly sets the line to continuous elements
19 corresponding to the PCR value of the line, in the cell read
20 sequence management table, from the set position corresponding
21 to the PCR value of the line recorded in the schedule
22 management table;

23 means which, when the communication of a line being
24 currently transferred has been deleted, cancels the setting of
25 the line from the element, in the cell read sequence management
26 table, to which the line has been set; and

27 means which, when new setting or delete of a transfer
28 object line has occurred, updates the catalog of the schedule
29 management table.

1 3. The scheduling system according to claim 2, wherein
2 the allocation processing means comprises:

3 means which converts the elements within the cell read
4 sequence management table, to respective specified positions
5 within the time slot, based on the designation of the slot
6 position as the conversion destination for each element
7 specified in such a manner that the continuous elements
8 corresponding to the PCR value, that have been ensured from a
9 position which is one element ahead of a position of an element
10 corresponding to a value obtained by multiplying the PCR value
11 by an integer, in the cell read sequence management table are
12 converted to respective positions dispersed at equal spacings
13 in the time slot; and

14 means which, when a line is in the state of being set to
15 elements in the cell read sequence management table, performs
16 specifying and setting, in a slot as the conversion destination
17 of the line in the time slot, so as to transfer cells of the
18 line.

1 4. The scheduling system according to claim 2 or 3,
2 whercin the number of slots in the time slot and the PCR value
3 of each of the lines each are a value obtained by raising "2"
4 to the nth power, wherein n is a non-negative integer.

1 5. The scheduling system according to claim 4, wherein
2 the conversion from the cell read sequence management
3 table to the time slot is carried out by a method comprising

4 the steps of:

5 raising "2" to the "Ath" power, wherein "A" is an
6 integer, to provide a value as the length of the time slot;

7 indicating the positions of the individual elements in
8 the cell read sequence management table and the slot positions
9 of the time slot by using continuous numbers from "1" to the
10 value of the time slot length;

11 taking each element from the cell read sequence
12 management table;

13 subtracting "1" from the value of the continuous numbers
14 in the element and expressing the obtained value in terms of
15 binary number of "A" digits while, when a high order value is
16 absent, supplementing "0";

17 converting the numerical values of the "A" digits
18 expressed in terms of binary number so as to be reversed in
19 sequence with respect to the arrangement from higher order
20 digit to lower order digit to provide a converted binary number
21 of "A" digits; and

22 adding "1" to the value of the converted binary number of
23 "A" digits to determine a value as a slot position, in the time
24 slot, which is the element conversion destination.

1 6. The scheduling system according to any one of claims 2
2 to 5, wherein the schedule computation means performs a
3 function such that, upon the cancellation of the setting of a
4 line from the elements in the cell read sequence management
5 table, if another line having a smaller PCR value than said
6 line is in the state of being set to a position behind the

7 position to which the said line has been set, the set position
8 of said another line is moved to the position from which the
9 setting of said line has been cancelled.

1 7. The scheduling system according to any one of claims 2
2 to 5, wherein the schedule computation means performs a
3 function such that, upon the cancellation of the setting of a
4 line from the elements in the cell read sequence management
5 table, if other lines having a smaller PCR value than said line
6 are in the state of being set to positions behind the position
7 to which the said line has been set, the set position of one
8 line, which has the largest PCR value in said other lines and
9 is located in the rearmost position of said other lines, is
10 moved to the position from which the setting of said line has
11 been cancelled.

1 8. The scheduling system according to any one of claims 1
2 to 7, wherein said line is an ATM line.

1 9. A scheduling method comprising the steps of:
2 indicating the send rate of cells in each line in terms
3 of PCR value which is the number of cells, transferred from the
4 line, per cell transfer turn;

5 successively transferring cells of a specified line
6 according to the sequence specified in slots, in a time slot
7 for specifying the transfer sequence of individual lines in the
8 cell transfer turn, indicating each point in the turn;

9 controlling the setting of each line in a cell read

10 sequence management table which has elements in the same number
11 as the number of slots provided in the time slot and sets the
12 lines as cell transfer objects to the elements;

13 converting the individual elements in the cell read
14 sequence management table to respective specified slot
15 positions in the time slot; and

16 properly updating and making reference to a schedule
17 management table which indicates positions, within the cell
18 read sequence management table, to which transfer object lines
19 are newly set, for each PCR value of the lines,

20 the cell read transfer sequence in each line being
21 controlled according to the cell send rate in each of the lines.

1 10. The scheduling method according to claim 9. which
2 further comprises the steps of:

3 when a requirement is satisfied such that there is an
4 element, in the cell read sequence management table, which is
5 located one element ahead of a position of an element
6 corresponding to a value obtained by multiplying the specified
7 PCR value by an integer, and the contemplated line can be set
8 to continuous elements starting from the idle element and
9 corresponding to the specified PCR value and, in addition, when
10 an element is present in the heading area of the continuous
11 elements, cataloging the position of said element, which is
12 located one element ahead of a position of an element
13 corresponding to a value obtained by multiplying the specified
14 PCR value by an integer, as data indicating the set position of
15 the line having the specified PCR value within the cell read

16 sequence management table, in relation with the PCR value in
17 the schedule management table;

18 when a line to be newly transferred has occurred, newly
19 setting the line to continuous elements corresponding to the
20 PCR value of the line, in the cell read sequence management
21 table, from the set position corresponding to the PCR value of
22 the line recorded in the schedule management table;

23 when the communication of a line being currently
24 transferred has been deleted, canceling the setting of the line
25 from the element, in the cell read sequence management table,
26 to which the line has been set; and

27 when new setting or delete of a transfer object line has
28 occurred, updating the catalog of the schedule management table.

1 11. The scheduling method according to claim 10, which
2 further comprises the steps of:

3 converting the elements within the cell read sequence
4 management table, to respective specified positions within the
5 time slot, based on the designation of the slot position as the
6 conversion destination for each element specified in such a
7 manner that the continuous elements corresponding to the PCR
8 value, that have been ensured from a position which is one
9 element ahead of a position of an element corresponding to a
10 value obtained by multiplying the PCR value by an integer, in
11 the cell read sequence management table are converted to
12 respective positions dispersed at equal spacings in the time
13 slot; and

14 when a line is in the state of being set to elements in

15 the cell read sequence management table, performing specifying
16 and setting, in a slot as the conversion destination of the
17 line in the time slot, so as to transfer cells of the line.

1 12. The scheduling method according to claim 10 or 11,
2 wherein the number of slots in the time slot and the PCR value
3 of each of the lines each are a value obtained by raising "2"
4 to the n th power, wherein n is a non-negative integer.

1 13. The scheduling method according to claim 12, wherein
2 the conversion from the cell read sequence management
3 table to the time slot is carried out by a method comprising
4 the steps of:

5 raising "2" to the " A th" power, wherein " A " is an
6 integer, to provide a value as the length of the time slot;

7 indicating the positions of the individual elements in
8 the cell read sequence management table and the slot positions
9 of the time slot by using continuous numbers from "1" to the
10 value of the time slot length;

11 taking each element from the cell read sequence
12 management table;

13 subtracting "1" from the value of the continuous numbers
14 in the element and expressing the obtained value in terms of
15 binary number of " A " digits while, when a high order value is
16 absent, supplementing "0";

17 converting the numerical values of the " A " digits
18 expressed in terms of binary number so as to be reversed in
19 sequence with respect to the arrangement from higher order

20 digit to lower order digit to provide a converted binary number
21 of "A" digits; and

22 adding "1" to the value of the converted binary number of
23 "A" digits to determine a value as a slot position, in the time
24 slot, which is the element conversion destination.

1 14. The scheduling method according to any one of claims
2 10 to 13, wherein, upon the cancellation of the setting of a
3 line from the elements in the cell read sequence management
4 table, if another line having a smaller PCR value than said
5 line is in the state of being set to a position behind the
6 position to which the said line has been set, the set position
7 of said another line is moved to the position from which the
8 setting of said line has been cancelled.

1 15. The scheduling method according to any one of claims
2 10 to 13, wherein, upon the cancellation of the setting of a
3 line from the elements in the cell read sequence management
4 table, if other lines having a smaller PCR value than said line
5 are in the state of being set to positions behind the position
6 to which the said line has been set, the set position of one
7 line, which has the largest PCR value in said other lines and
8 is located in the rearmost position of said other lines, is
9 moved to the position from which the setting of said line has
10 been cancelled.

1 16. The scheduling method according to any one of claims
2 9 to 15, wherein said line is an AMT line.

1 17. An ATM switch comprising a scheduling system such
2 that the cell read transfer sequence in each ATM line is
3 controlled according to the cell send rate in each of the ATM
4 lines, wherein

5 said scheduling system

6 expresses the cell send rate, in each of the ATM lines,
7 in terms of PCR value, which is the number of cells,
8 transferred from the ATM line, per cell transfer turn and
9 comprises:

10 a time slot for specifying the transfer sequence of the
11 ATM lines in one turn, in which each cell is transferred, in
12 slots indicating respective points in the turn;

13 a cell read sequence management table which has elements
14 in the same number as the number of slots provided in the time
15 slot and sets the ATM lines as cell transfer objects to the
16 elements;

17 schedule computation means for controlling the setting of
18 the ATM lines to the cell read sequence management table;

19 allocation processing means for converting the elements
20 of the cell read sequence management table respectively to
21 specified positions of the slots in the time slot; and

22 a schedule management table for indicating positions,
23 within the cell read sequence management table, to which
24 transfer object ATM lines are newly set, for each PCR value of
25 the ATM lines,

26 the specified ATM line cells being successively
27 transferred for each turn according to the sequence specified

28 in the time slot.

1 18. The ATM switch according to claim 17, wherein

2 the schedule computation means comprises:

3 means which, when a requirement is satisfied such that
4 there is an idle element, in the cell read sequence management
5 table, which is located one element ahead of a position of an
6 element corresponding to a value obtained by multiplying the
7 specified PCR value by an integer, and the contemplated ATM
8 line can be set to continuous elements starting from the idle
9 element and corresponding to the specified PCR value and, in
10 addition, when an element is present in the heading area of the
11 continuous elements, functions to catalog the position of said
12 element, which is located one element ahead of a position of an
13 element corresponding to a value obtained by multiplying the
14 specified PCR value by an integer, as data indicating the set
15 position of the ATM line having the specified PCR value, in
16 relation with the PCR value in the schedule management table;

17 means which, when an ATM line to be newly transferred has
18 occurred, newly sets the ATM line to continuous elements
19 corresponding to the PCR value of the ATM line, in the cell
20 read sequence management table, from the set position
21 corresponding to the PCR value of the ATM line recorded in the
22 schedule management table;

23 means which, when the communication of an ATM line being
24 currently transferred has been deleted, the setting of the ATM
25 line is cancelled from the element, in the cell read sequence
26 management table, to which the ATM line has been set; and

27 means which, when new setting or delete of a transfer
28 object ATM line has occurred, updates the catalog of the
29 schedule management table.

1 19. The ATM switch according to claim 18, wherein
2 the allocation processing means comprises:

3 means which converts the elements within the cell read
4 sequence management table, to respective specified positions
5 within the time slot, based on the designation of the slot
6 position as the conversion destination for each element
7 specified in such a manner that the continuous elements
8 corresponding to the PCR value, that have been ensured from a
9 position which is one element ahead of a position of an element
10 corresponding to a value obtained by multiplying the PCR value
11 by an integer, in the cell read sequence management table are
12 converted to respective positions dispersed at equal spacings
13 in the time slot; and

14 means which, when an ATM line is in the state of being
15 set to elements in the cell read sequence management table,
16 performs specifying and setting, in a slot as the conversion
17 destination of the ATM line in the time slot, so as to transfer
18 cells of the ATM line.

1 20. The ATM switch according to claim 18 or 19, wherein
2 the number of slots in the time slot and the PCR value of each
3 of the ATM lines each are a value obtained by raising "2" to
4 the nth power, wherein n is a non-negative integer.

1 21. The ATM switch according to claim 20, wherein
2 the conversion from the cell read sequence management
3 table to the time slot is carried out by a method comprising
4 the steps of:

5 raising "2" to the "Ath" power, wherein "A" is an
6 integer, to provide a value as the length of the time slot;

7 indicating the positions of the individual elements in
8 the cell read sequence management table and the slot positions
9 of the time slot by using continuous numbers from "1" to the
10 value of the time slot length;

11 taking each element from the cell read sequence
12 management table;

13 subtracting "1" from the value of the continuous numbers
14 in the element and expressing the obtained value in terms of
15 binary number of "A" digits while, when a high order value is
16 absent, supplementing "0";

17 converting the numerical values of the "A" digits
18 expressed in terms of binary number so as to be reversed in
19 sequence with respect to the arrangement from higher order
20 digit to lower order digit to provide a converted binary number
21 of "A" digits; and

22 adding "1" to the value of the converted binary number of
23 "A" digits to determine a value as a slot position, in the time
24 slot, which is the element conversion destination.

1 22. The ATM switch according to any one of claims 18 to
2 21, wherein the schedule computation means performs a function
3 such that, upon the cancellation of the setting of an ATM line

4 from the elements in the cell read sequence management table,
5 if another ATM line having a smaller PCR value than said ATM
6 line is in the state of being set to a position behind the
7 position to which the said ATM line has been set, the set
8 position of said another ATM line is moved to the position from
9 which the setting of said ATM line has been cancelled.

1 23. The ATM switch according to any one of claims 18 to
2 21, wherein the schedule computation means performs a function
3 such that, upon the cancellation of the setting of an ATM line
4 from the elements in the cell read sequence management table,
5 if other ATM lines having a smaller PCR value than said ATM
6 line are in the state of being set to positions behind the
7 position to which the said ATM line has been set, the set
8 position of one ATM line, which has the largest PCR value in
9 said other ATM lines and is located in the rearmost position of
10 said other ATM lines, is moved to the position from which the
11 setting of said ATM line has been cancelled.